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**ATTORNEY DOCKET NO. 10031375-1**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

**Inventor(s):** Ken A. Nishimura, et al.

**Serial No.:** 10/736,724 **Examiner:** Hung Nguyen

**Filing Date:** December 15, 2003 **Group Art Unit:** 2851

**Title:** DEFECT MITIGATION IN SPATIAL LIGHT MODULATOR USED FOR DYNAMIC PHOTOLITHOGRAPHY

**COMMISSIONER FOR PATENTS**
**P.O. Box 1450**
**Alexandria VA 22313-1450**

## TRANSMITTAL OF APPEAL BRIEF

Sir:

Transmitted herewith is the Appeal Brief in this application with respect to the Notice of Appeal filed on

The fee for filing this Appeal Brief is (37 CFR 1.17(c)) **$500.00**.

**(complete (a) or (b) as applicable)**

The proceedings herein are for a patent application and the provisions of 37 CFR 1.136(a) apply.

☐ (a) Applicant petitions for an extension of time under 37 CFR 1.136 (fees: 37 CFR 1.17(a)(1)-(5)) for the total number of months checked below:

| | | |
|---|---|---|
| ☐ | one month | $ 120.00 |
| ☐ | two months | $ 450.00 |
| ☐ | three months | $1020.00 |
| ☐ | four months | $1590.00 |

☐ The extension fee has already been filled in this application.

☒ (b) Applicant believes that no extension of term is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

Please charge to Deposit Account **50-1078** the sum of $500.00. At any time during the pendency of this application, please charge any fees required or credit any overpayment to Deposit Account **50-1078** pursuant to 37 CFR 1.25.

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Respectfully submitted,

Ken A. Nishimura, et al.

By

Holly L. Rudnick
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Date: June 8, 2006

Telephone No. 214-387-8097

**DOCKET NO.: 10031375-1** **PATENT**
**CLIENT NO.: AGIL01-00219**

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In the Application of:

KEN A. NISHIMURA et al.

Serial No. 10/736,724

Filed: December 15, 2003

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For: DEFECT MITIGATION IN SPATIAL LIGHT MODULATOR USED FOR DYNAMIC PHOTOLITHOGRAPHY

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PHIL RUDNICK

Dear Sir:

## APPEAL BRIEF

The Appellants have appealed to the Board of Patent Appeals and Interferences from the decision of the Examiner dated January 19, 2006, finally rejecting Claims 1-25. The Appellants filed a Notice of Appeal on April 11, 2006. The Appellants respectfully submit this brief on appeal, in triplicate, with the statutory fee of $500.00.

## REAL PARTY IN INTEREST

This application is currently owned by Agilent Technologies, Inc., a Delaware corporation having its principal place of business in Santa Clara, California.

## RELATED APPEALS AND INTERFERENCES

There are no known appeals or interferences that will directly affect or be directly affected by or have a bearing on the Board's decision in this pending appeal.

## STATUS OF CLAIMS

Claims 1-25 are pending in the above-identified patent application. Claims 1-25 have been rejected, and are presented for appeal herein. Claims 1-25 are shown in the attached Claims Appendix.

## STATUS OF AMENDMENTS

An Amendment after Final Rejection was mailed on March 9, 2006, and received by the Patent and Trademark Office on March 13, 2006. An Advisory Action was mailed on March 22, 2006. In the Advisory Action, the Examiner stated that the proposed amendments would not be entered because "they raise new issues that would require further consideration and/or search"; and because "they are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal."

## SUMMARY OF INVENTION

According to one embodiment, a photolithography apparatus, shown in Figures 1, 2A, 2B and 9, is provided with light modulation elements 210 and memory elements 902. *Application, Page 10, Line 11 – Page 12, Line 12.* The light modulation elements 210 include a first set of light modulation elements and a second set of light modulation elements, each operable to photolithographically transfer a portion of an image onto an area of a substrate, as shown in Figures 4-6. *Application, Page 9, Lines 8-15; and Application Page 12, Line 14 – Page 13, Line 6.* Each of the memory elements 902 is in communication with a respective one of the light modulation elements 210. In addition, the memory elements 902 are configured to store data representing the portion of the image. *Application, Page 19, Lines 12-17.*

In further embodiments, the image is divided into image sections, and the image sections are further divided into image subsections. The portion of the image transferred by the first and second sets of light modulation elements corresponds to one of the image subsections. In addition, the light modulation elements are divided into sections, in which each light modulation element section is capable of transferring one of the image subsections, such that the first set of light modulation elements corresponds to one of the light modulation element sections and the second set of light modulation elements corresponds to another light modulation element section. *Application, Page12, Line14 – Page 15, Line 20.*

According to another embodiment, a photolithography system, shown in Figures 1, 2A and 2B, is provided with a spatial light modulator 110 including light modulation elements 210. *Application, Page 9, Lines 8-15; and Application, Page 10, Line 11 – Page 12, Line 12.* The light modulation elements 210 include a first set of light modulation elements and a second set of light modulation elements, each operable to photolithographically transfer a portion of an image onto an area of a substrate 150, as shown in Figures 4-6. *Application, Page 12, Line 14 – Page*

*13, Line 6*. The photolithography system further includes a stage 120 operable to move one of the spatial light modulator 110 and the substrate 150 relative to the other. *Application, Page 9, Lines 15-21*.

## GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

(1) Whether Claims 1-4, 6-17, 19 and 21-25 are anticipated under 35 U.S.C. § 102(b) by U.S. Patent No. 5,721,622 to Venkateswar ("*Venkateswar*"); and

(2) Whether Claims 1-17 and 29-25 are anticipated under 35 U.S.C. § 102(b) by U.S. Patent No. 6,618,185 to Sandstrom ("*Sandstrom*").

# ARGUMENT

## I. OVERVIEW

Claims 1-4, 6-17, 19 and 21-25 stand rejected under 35 U.S.C. § 102(b) as being anticipated by *Venkateswar*. In addition, Claims 1-21 stand rejected under 35 U.S.C. § 102(b) as being anticipated by *Sandstrom*.

## II. STANDARD

A cited prior art reference anticipates the claimed invention under 35 U.S.C. § 102 only if every element of a claimed invention is identically shown in that single reference, arranged as they are in the claims. MPEP § 2131; *In re Bond*, 910 F.2d 831, 832, 15 U.S.P.Q.2d 1566, 1567 (Fed. Cir. 1990). Anticipation is only shown where each and every limitation of the claimed invention is found in a single cited prior art reference. MPEP § 2131; *In re Donohue*, 766 F.2d 531, 534, 226 U.S.P.Q. 619, 621 (Fed. Cir. 1985).

## III. REJECTIONS USING *VENKATESWAR*

### A. THE *VENKATESWAR* REFERENCE

*Venkateswar* recites a digital micro-mirror device (DMD) 12 including a number of mirror elements for transferring light from a light source 14 onto a printer drum 16 to produce a greyscale image. The drum 16 is rotating, such that light is received at a line of pixels on the drum 16 from different rows of mirrors on the DMD 12 at different times. *Venkateswar, Column 4, Lines 5-11 and 25-28; and Figure 1.* In the example shown in *Venkateswar*, the DMD 12 includes four rows of mirrors with sixteen mirrors per row. Thus, as illustrated in Figure 1, each pixel (e.g., pixel 20 or 46) of any given image line on the printer drum 16 is sequentially exposed

by a column of four mirrors. Therefore, a given image line on the drum (i.e., a row of pixels extending longitudinally along the drum) is produced by a sequence of four exposures, wherein four rows of mirrors are used, respectively, to make the four exposures of the sequence. *Venkateswar, Column 4, Lines 36-44.*

In order to achieve the appropriate greyscale value at each pixel on the drum 16, a lookup table is stored in memory that contains data representing the greyscale value for each pixel. The greyscale values are used as the basis for microimage data that is loaded into the DMD 12 each exposure period. *Venkateswar, Column 5, Lines 18-29; and Figure 2.* In particular, as shown in Figure 5, each greyscale value is expressed in terms of a number of exposures needed at each pixel (i.e., a number of times a micromirror focusing light on that pixel is in an "ON" state). Thus, a particular greyscale value at a particular pixel is achieved by placing each mirror in a column of mirrors in either an "ON" state or an "OFF" state. For example, as stated in *Venkateswar, Column 5, Line 57 – Column 6, Line 1:*

> "At the beginning of each new exposure period, the DMD 12 is addressed with a new set of data. The data delivered to each mirror is binary in the sense that it indicates whether that mirror should be ON or OFF during that exposure period. The binary data (0 or 1 values) for all mirrors of DMD to be addressed during a single exposure period is referred to as "microimage" data. In the example of FIG. 3, four microimages, $m_0$-$m_3$, are superposed to represent the final image. ...
>
> The microimages can be visualized as moving down the "page" represented by pixels on drum 16. In the example shown, DMD 12 moves down the page one line at a time. At each new position, DMD 12 receives new data and generates a new microimage."

Therefore, each microimage transferred by any given row of mirrors of the DMD 12 is a microimage that has been updated with respect to the microimage transferred by the row of mirrors that performed the immediately preceding exposure. *Venkateswar, Column 5, Lines 49-50; Column 5, Line 64 – Column 6, Line 1; and Column 6, Lines 5-13.* Using the example of four rows of mirrors, each of the four rows of mirrors transfers its own respective microimage

onto a given line of pixels on the drum 16, such that the light exposure accumulation at any particular pixel is sufficient to produce the desired greyscale value.

As an example, referring again to Figure 1, to achieve a greyscale value of "1" at pixel 46, during a first exposure period, mirror 38 would be in an "ON" position to transfer light onto pixel 46, during a second exposure period mirror 40 would be in an "OFF" position so that light is not transferred onto pixel 46, during a third exposure period, mirror 42 would be in an "OFF" position so that light is not transferred onto pixel 46 and during a fourth exposure period, mirror 44 would be in an "OFF" position so that light is not transferred onto pixel 46. Therefore, the image data loaded into mirrors 38-42 differ in order to achieve the correct greyscale value.

## B. CLAIMS 1-4, 6-17, 19 and 21-25 as rejected using *VENKATESWAR*

The Examiner has not shown that *Venkateswar* teaches all of the elements of Claims 1-4, 6-17, 19 and 21-25. Specifically, Appellants respectfully submit that *Venkateswar* does not teach (expressly or inherently) at least the following feature recited in independent Claim 11 (similar features can be found in independent Claims 1, 7 and 22): *"a first set of said light modulation elements operable to photolithographically transfer a portion of an image onto an area of a substrate, and a second set of said light modulation elements operable to photolithographically transfer the portion of the image onto the area of the substrate."*

On Page 6 of the Final Office Action of January 19, 2006, the Examiner contended that the "first set of light modulation elements" in Claim 11 is taught by mirrors 28, 36, ... 44 in Figure 1 of *Venkateswar*, and "the second set of light modulation elements" in Claim 11 is taught by mirrors 26, 34 ... 42 in Figure 1 of *Venkateswar*. However, Appellants have not found in *Venkateswar* any teaching that, for any given image line on the drum 19, one of the four rows of mirrors transfers a microimage onto the image line, and another of the four rows of mirrors

transfers the microimage onto the image line. Instead, as described above, it appears that each of the four rows of mirrors transfers its own respective microimage onto the given image line, and that the microimage transferred by any given row of mirrors is a microimage that has been updated to provide the appropriate cumulative greyscale value with respect to the microimage transferred by the row of mirrors that performed the immediately preceding exposure. *Venkateswar, Column 5, Lines 49-50; Column 5, Line 64 – Column 6, Line 1; and Column 6, Lines 5-13.* It is submitted in view of the foregoing that *Venkateswar* fails to teach the aforementioned exemplary feature of Claims 1, 7, 11 and 22.

For these reasons, the Examiner has not shown that *Venkateswar* teaches the Appellants' invention as recited in Claims 1, 7, 11 and 22. As a result, Claims 1, 7, 11 and 22 (and their dependents) are allowable over the art of record. Accordingly, Appellants respectfully request the withdrawal of the § 102 rejection and full allowance of Claims 1-4, 6-17, 19 and 21-25.

## IV. REJECTIONS USING *SANDSTROM*

### A. THE *SANDSTROM* REFERENCE

*Sandstrom* recites an apparatus 1 for patterning a work piece 60 (e.g., a substrate) that employs a spatial light modulator (SLM) 30 including an array of pixels (e.g., mirrors) 110. *Figure 1; and Figure 3.* The SLM 30 is illuminated with light from a light source 10 to transfer an image (pattern) onto the work piece 60. The image from the SLM 30 typically covers only a small portion of the work piece 60, and therefore, the complete pattern is transferred onto the work piece 60 by stitching together multiple SLM image patterns. *Column 9, Lines 8-10, 28-42 and 53-57.*

*Sandstrom* compensates for defective pixels in the SLM 30 by performing multiple

writing passes over the work piece 60. *Sandstrom, Column 2, Lines 57-67; Column 9, Lines 57-64; Column 11, Lines 5-14.* For example, as seen from *Sandstrom* Figure 2 and the corresponding description, an image portion (also referred to as a "stamp" in *Sandstrom*) transferred by the SLM 30 during a second writing pass is offset by a predetermined spatial distance (i.e., a number of pixels) from an image portion transferred by the SLM 30 during the first writing pass. *Sandstrom, Figure 2; Column 9, Lines 42-50; Column 10, Lines 32-45.* Thus, during a first writing pass, the pixels in the SLM 30 are programmed to transfer a first image portion onto a first area of the work piece 60, and during a second writing pass, the pixels in the SLM 30 are programmed to transfer a different, second image portion onto a different, second area of the work piece 60, in which the first and second image portions and the first and second work piece areas overlap. As a result, in *Sandstrom*, the images (or stamps), such as those shown in Figure 2 represent different patterns. *Sandstrom, Column 9, lines 53-57.*

### B. CLAIMS 1-25 as rejected using *SANDSTROM*

The Examiner has not shown that *Sandstrom* teaches all of the elements of Claims 1-25. Specifically, Appellants respectfully submit that *Sandstrom* does not teach (expressly or inherently) at least the following feature recited in independent Claim 11 (similar features can be found in independent Claims 1, 7 and 22): "*a first set of said light modulation elements operable to photolithographically transfer a portion of an image onto an area of a substrate, and a second set of said light modulation elements operable to photolithographically transfer the portion of the image onto the area of the substrate.*"

On Page 7 of the Final Office Action of January 19, 2006, the Examiner contended that the "first set of light modulation elements" and "second set of light modulation elements" in

Claim 11 is taught in *Column 2, Lines 57-67* of *Sandstrom*, which recites "*projecting in a first writing pass an image of said modulator on said work piece using a first set of pixels in said SLM ... and projecting in at least a second writing pass said image of said modulator on said work piece using at least a second set of pixels in said SLM.*" However, as described above, the images (or stamps) transferred in the different writing passes represent different patterns. *Sandstrom, Column 9, lines 53-57.*

For these reasons, the Examiner has not shown that *Sandstrom* teaches the Appellants' invention as recited in Claims 1, 7, 11 and 22. As a result, Claims 1, 7, 11 and 22 (and their dependents) are allowable over the art of record. Accordingly, Appellants respectfully request the withdrawal of the § 102 rejection and full allowance of Claims 1-25.

## CONCLUSION

The Appellants have demonstrated that the present invention as claimed is clearly distinguishable over the prior art cited of record. Therefore, the Appellants respectfully request the Board of Patent Appeals and Interferences to reverse the final rejection of the Examiner and instruct the Examiner to issue a notice of allowance of all claims.

Respectfully submitted,

Ken A. Nishimura et al.

Date: 6/8/2006

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## CLAIMS APPENDIX

1. (Original) A method for performing photolithography, comprising:

providing a spatial light modulator with data representing a portion of an image to be photolithographically transferred to a substrate, the spatial light modulator comprising light modulation elements;

transferring the portion of the image from a first set of the light modulation elements onto an area of the substrate; and

transferring the portion of the image from a second set of the light modulation elements onto the area of the substrate.

2. (Original) The method according to claim 1, further comprising:

dividing the image into image sections; and

dividing the image sections into image subsections, the portion of the image transferred to the substrate corresponding to at least one of the image subsections.

3. (Original) The method according to claim 2, further comprising:

dividing the light modulation elements into light modulation banks, each light modulation bank being capable of transferring one of the image subsections.

4. (Original) The method according to claim 1, wherein said transferring the portion of the image from the first set of light modulation elements further comprises:

loading data representing the portion of the image into the first set of light modulation elements; and

altering the state of ones of the first set of light modulation elements in response to the data.

5. (Original) The method according to claim 4, wherein the first set of light modulation elements includes a defective light modulation element, and wherein said transferring the portion of the image from the second set of light modulation elements further comprises:

placing one of the light modulation elements in the second set of light modulation elements corresponding to the defective light modulation element in the first set of light modulation elements in the correct state as a function of the data loaded into the second set of light modulation elements.

6. (Original) The method of claim 1, further comprising:

transferring the portion of the image from at least a third set of the light modulation elements onto the area of the substrate.

7. (Original) A method for performing photolithography, comprising:

positioning a substrate having a photosensitive surface in relation to a spatial light modulator comprising light modulation elements;

exposing an area of the photosensitive surface with a portion of an image in response to respective states of a first set of the light modulation elements;

altering the positional relationship between the substrate and the spatial light modulator; and

exposing the area of the photosensitive surface with the portion of the image in response to respective states of a second set of the light modulation elements.

8. (Original) The method according to claim 7, further comprising:

achieving grayscale in the image on the area of the photosensitive surface using both said exposings.

9. (Original) The method according claim 7, further comprising:

integrating the total energy from each said exposing on the area of the photosensitive surface.

10. (Original) The method according to claim 7, further comprising:

exposing the area of the photosensitive surface with the portion of the image in response to respective states of a third set of the light modulation elements.

11. (Original) A photolithography apparatus, comprising:

light modulation elements, a first set of said light modulation elements operable to photolithographically transfer a portion of an image onto an area of a substrate, and a second set of said light modulation elements operable to photolithographically transfer the portion of the image onto the area of a substrate; and

memory elements in communication with respective ones of said light modulation elements, said memory elements being configured to store data representing the portion of the image.

12. (Original) The photolithography apparatus according to claim 11, wherein the image is divided into image sections and the image sections are divided into image subsections, and the portion of the image corresponds to one of the image subsections.

13. (Original) The photolithography apparatus according to claim 12, wherein said light modulation elements are divided into sections, each light modulation element section being capable of transferring one of the image subsections, the first set of light modulation elements being one of the light modulation element sections and the second set of light modulation elements being another one of the light modulation element sections.

14. (Original) The photolithography apparatus according to claim 13, wherein said light modulation elements are arranged in an array having rows and columns.

15. (Original) The photolithography apparatus according to claim 14, wherein the first and second sets of light modulation elements include one or more respective ones of the rows.

16. (Original) The photolithography apparatus according to claim 14, wherein the first and second sets of light modulation elements include one or more respective ones of the columns.

17. (Original) The photolithography apparatus according to claim 11, wherein said light modulation elements comprise liquid crystal material.

18. (Original) The photolithography apparatus according to claim 17, wherein said light modulation elements further comprise:

a common electrode configured to receive a common electrode signal for said light modulation elements; and

pixel electrodes configured to receive the data stored in said respective memory elements.

19. (Original) The photolithography apparatus according to claim 11, wherein said light modulation elements comprise micromirrors.

20. (Original) The photolithography apparatus according to claim 11, wherein the first set of light modulation elements includes a defective light modulation element, and wherein one of the light modulation elements in the second set of light modulation elements corresponding to the defective light modulation element in the first set of light modulation elements is not defective.

21. (Original) The photolithography apparatus according to claim 11, wherein a third set of light modulation elements is operable to photolithographically transfer the portion of the image onto the area of the substrate.

22. (Original) A photolithography system for transferring an image to a substrate having a photosensitive surface, said system comprising:

a spatial light modulator including light modulation elements, a first set of the light modulation elements operable to transfer a portion of an image onto an area of a substrate, and a second set of the light modulation elements operable to transfer the portion of the image onto the area of a substrate; and

a stage operable to move one of said spatial light modulator and the substrate relative to the other.

23. (Original) The photolithography apparatus according to claim 22, further comprising:

a laser optically coupled to said spatial light modulator to illuminate said spatial light modulator with light.

24. (Original) The photolithography apparatus according to claim 23, wherein the first and second sets of light modulation elements minimize spatial variations in the intensity of the light transferred to the substrate.

25. (Original) The photolithography system according to claim 22, wherein the light modulation elements further include respective memory elements configured to store data representing the respective portion of the image, the light modulation elements being alterable in response to the data stored in the respective memory elements.

## EVIDENCE APPENDIX

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## RELATED PROCEEDING APPENDIX

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